transistors are substantially the same film thickness and wherein a drain concentration of thin-film transistors (TFT) is in a range of about $3E+19/cm^3$ to $1E+20/cm^3$.

[11] Thus, according to the present invention, it is possible to form a plurality of thin-film transistors (TFTs) having a lower driving voltage and thin-film transistors having a higher driving voltage on a glass substrate at a single gate insulating film by setting the range of drain concentration. The range of the drain concentration of the P-type TFTs may be in the range of $3E+19/cm^3$ to $1E+20/cm^3$. Therefore, it is possible to simplify the process of forming at least two types of TFTs having different driving voltages on an insulting glass substrate, thereby resulting in a greatly improved throughput.

[12] According to a third aspect of the present invention, a thin-film semiconductor device manufacturing method comprises forming substantially the same thickness of gate insulating films of a plurality of thin-film transistors (TFTs) having different driving voltages formed on a glass substrate at one time. Thus, according to the present invention, it is possible to form a plurality of thin-film transistors (TFTs) having different driving voltage on an glass substrate at a single gate insulating film. Therefore, it results in a greatly improved throughput.

BRIEF DESCRIPTION OF THE DRAWINGS

[13] Fig. 1 is the cross-sectional view showing a conventional structure of a semiconductor.

[14] Fig. 2 is a cross-sectional view showing a structure of a thin-film semiconductor device related to a first embodiment of the present invention.

[15] Figs. 3 (a) and 3 (b) are cross-sectional views showing steps of a manufacturing method of the present invention.

[16] Figs. 4 (a) through 4(c) are cross-sectional views showing steps of a manufacturing method of the present invention.

[17] Figs. 5 (a) and 5(b) are cross-sectional views showing steps of a manufacturing method of the present invention.

[18] Figs. 6 (a) through 6(c) are cross-sectional views showing steps of a manufacturing method of the present invention.

[19] Fig. 7 is a cross-sectional view showing a structure of a thin-film semiconductor device related to a second embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[20] [First embodiment]

[21] Fig.2 shows a cross-sectional view showing a structure of a thin-film semiconductor device comprising a plurality of TFTs having different driving voltages related to a first illustrative embodiment of the present invention. Fig.3 through Fig.6 show cross-sectional view showing steps of a manufacturing method of the thin-film semiconductor device of the first embodiment in the present invention.

[22] As shown in Fig.2, an undercoat layer 102 is formed on a glass substrate 100, and amorphous or poly-crystalline silicon films 106-109 are formed on the undercoat layer. The gate insulating films 114-117 are provided on the amorphous or poly-crystal silicon films 106-109, and gate electrodes 110-113 are formed over the respective channel regions.

[23] The glass substrate 100 may be on a transparent insulating substrate made of glass or plastic, a silicon oxide film (SiOx). The undercoat layer 102 is provided to prevent an impurity from being diffused from the glass substrate 100 into an active layer and so it is not